

SPECIFICATION

Atty Dkt: F-9191

Identifier: Georg HIMMELSBACH

Claims

1. Method for grinding bearings and cams of assembled camshafts and for straightening the same on a grinding machine, in which straightening occurs after a grinding process on the same grinding machine.
- 5 2. Method in accordance with claim 1, in which the straightening of the camshaft is performed after the bearings are finish-ground and/or after the cams are rough-ground and/or after the cams are finish-ground.
- 10 3. Method in accordance with claim 1 or 2, in which the method steps of finish-grinding the bearings, rough-grinding and finish-grinding the cams, and straightening are performed in a single chucking.
4. Method in accordance with any of claims 1 through 3, in which the bearings of the camshaft are finish-ground at a first station of the grinding machine and the cams of the camshaft are rough-ground and finish-ground at a second station.
- 15 5. Method for grinding bearings and cams of assembled camshafts and for straightening the same, in which the bearings are finish-ground on a first grinding machine and the camshaft is subsequently straightened on the first grinding machine and the cams of the camshaft are rough-ground and finish-ground on a second grinding machine.
- 20 6. Method for grinding bearings and cams of assembled camshafts and for straightening the same, in which the bearings are finish-ground on a first grinding

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machine and the cams of the camshaft are rough-ground and finish-ground on a second grinding machine and after said rough-grinding and/or finish-grinding the camshaft is straightened on the second grinding machine.

7. Method in accordance with claim 5 or 6, in which the cams of the camshaft

5 are rough-ground at a first station of the second grinding machine and the cams of the camshaft are finish-ground at a second station of the second grinding machine.

8. Method in accordance with any of claims 1 through 7, in which during the grinding of the bearings the camshaft is supported in the area of bearings and for straightening the supports are removed from contact with the bearing.

10 9. Method in accordance with claim 8, in which after the cams have been rough-ground the supports are re-positioned at the areas of the bearings in question and then the cams are finish-ground.

10. Method in accordance with claim 5 or 6, in which the cams of the camshaft are rough-ground on the second grinding machine with positioned

15 supports, then the supports are removed at least from a center area of the camshaft and then the straightening occurs, whereupon the supports are re-positioned in this area of the bearings and then the cams are finish-ground.

11. Method in accordance with any of claims 1 through 10, in which prior to the straightening a concentricity value or concentricity deviation value is measured for at least one bearing in the center area of the camshaft.

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12. Method in accordance with claim 11, in which the camshaft is straightened based on the measured concentricity value or concentricity deviation value.

13. Method in accordance with any of claims 1 through 12, in which the straightening occurs with the camshaft rotating at a speed of in particular 50 to 5 200 revolutions per minute.

14. Method in accordance with claim 13, in which a pressure force is exerted on the camshaft in the area of its center bearing during the straightening.

15. Method in accordance with any of claims 1 through 12, in which the straightening occurs with a stationary camshaft, whereby first the bearing with the greatest deviation from concentricity is determined and a pressure force is introduced to this bearing, relative to the circumference, in the area of the radial position at which this highest concentricity deviation is present.

16. Method in accordance with any of claims 1 through 15, in which during straightening the camshaft is subjected to pressure at least by area beyond the yield point of the material of its steel tube, whereupon there is a gradual removal of the bend in the camshaft to essentially 0 mm.

17. Method in accordance with claim 4 or 7, in which straightening occurs at the first station.

18. Method in accordance with any of claims 4, 7, or 17, in which straightening occurs at the second station.

19. Apparatus for grinding bearings (2) and/or cams (3) of an assembled

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camshaft (1) and for straightening such a camshaft, in particular for performing the method in accordance with any of claims 1 through 18, which has a grinding machine (4) with a straightening device (6) integrated into said grinding machine for straightening said camshaft (1) after a grinding process.

5 20. Apparatus in accordance with claim 19, in which a concentricity measuring device (5) for measuring the concentricity or the concentricity deviation of said camshaft (1) is integrated into the grinding machine (4).

10 21. Apparatus in accordance with claim 20, in which said grinding machine (4) has a grinding headstock (7), borne on a machine bed (8) and having at least two grinding wheels (9, 10) that can each be pivoted into a grinding position, and has a workpiece headstock (12) and a tailstock (13) that are embodied such said camshaft (1) can be gripped between centers (14) and said concentricity measuring device (5) is attached to said grinding headstock (7) or to said machine bed (8) and said straightening device (6) is attached to said grinding headstock (7).

15 22. Apparatus in accordance with any of claims 19 through 21, in which said grinding machine (4) has a first station (15) and a second station (16).

20 23. Apparatus in accordance with claim 22, in which said first station (15) is embodied such that a) it is possible to finish-grind said bearings (2) of said camshaft (1) on it or b) it is possible to finish-grind said bearings (2) and to rough-grind said cams (3) on it.

24. Apparatus in accordance with claim 22 or 23, in which a straightening device (6) is arranged in said first station (15).

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25. Apparatus in accordance with any of claims 22 through 24, in which said second station (16) is embodied such that it is possible to rough-grind and/or finish-grind said cams (3) of said camshaft (1) on it.

26. Apparatus in accordance with any of claims 22 through 24, in which a 5 straightening device (6) is arranged in said second station (16).

27. Apparatus in accordance with any of claims 19 through 26, in which said straightening device (6) is a roll straightening head (17) that is embodied such that the straightening can be performed with said camshaft (1) rotating.

28. Apparatus in accordance with claim 27, in which said roll straightening head (17) has two borne rollers (18) in its forward area, is attached to said grinding headstock (7), and in particular can be moved in the X-direction toward said bearings (2) of said camshaft (1). 10

29. Apparatus in accordance with any of claims 19 through 26, in which said straightening device (6) is a pressure element straightening head (19) that is 15 embodied such that the straightening can be performed with said camshaft (1) stationary.

30. Apparatus in accordance with claim 29, in which said pressure element straightening head (19) has a borne prism (20) having a recess (21) for introducing a straightening force into a bearing (2) of said camshaft (1) via at least two 20 circumferentially spaced locations.

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31. Apparatus in accordance with claim 29, in which said pressure element straightening head (19) has a pressure element (22) having a largely flat surface for introducing a straightening force into a bearing (2) of said camshaft (1) via one location.